SWIM Connect 2015

Information Sharing in Commercial Space:

Space Vehicle Operations

SWIM for Launch and Reentry Operations

Kevin Hatton
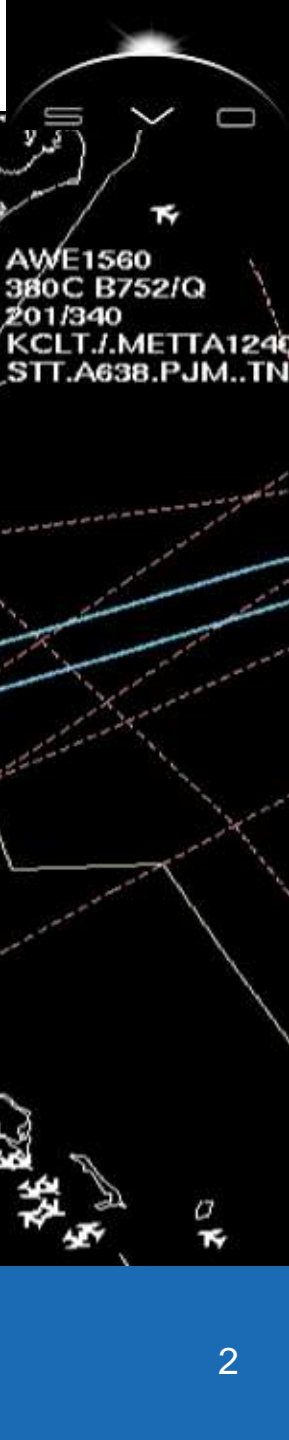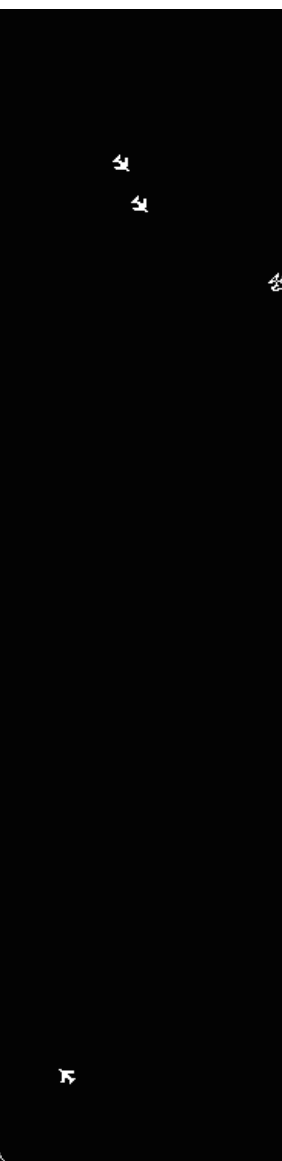SVO Program Manager, ANG-C54
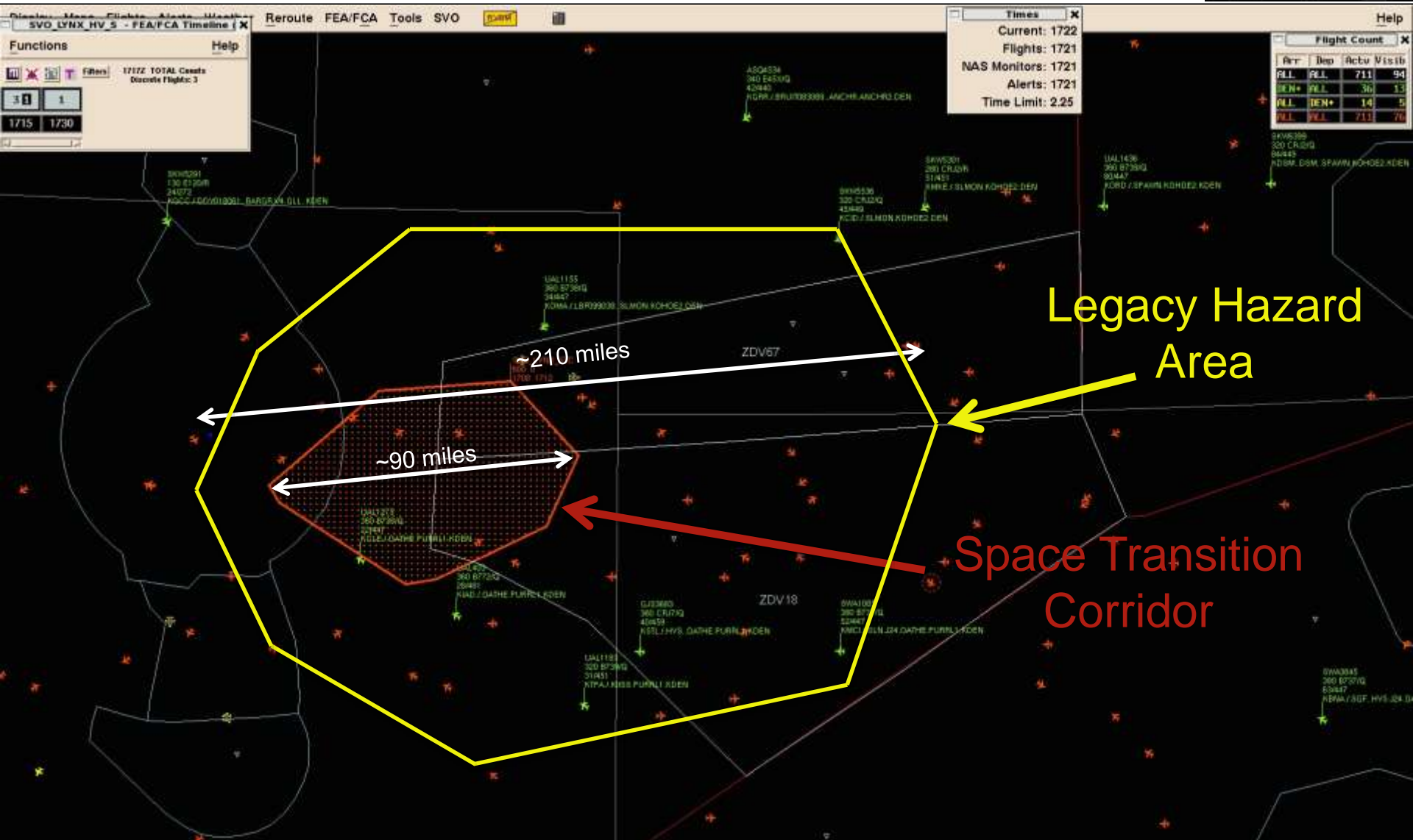
November 4, 2015

Federal Aviation Administration

NAS Impact of a Launch

Federal Aviation Administration

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STC vs. Legacy Hazard Areas

Legacy Hazard Area

~210 miles

~90 miles
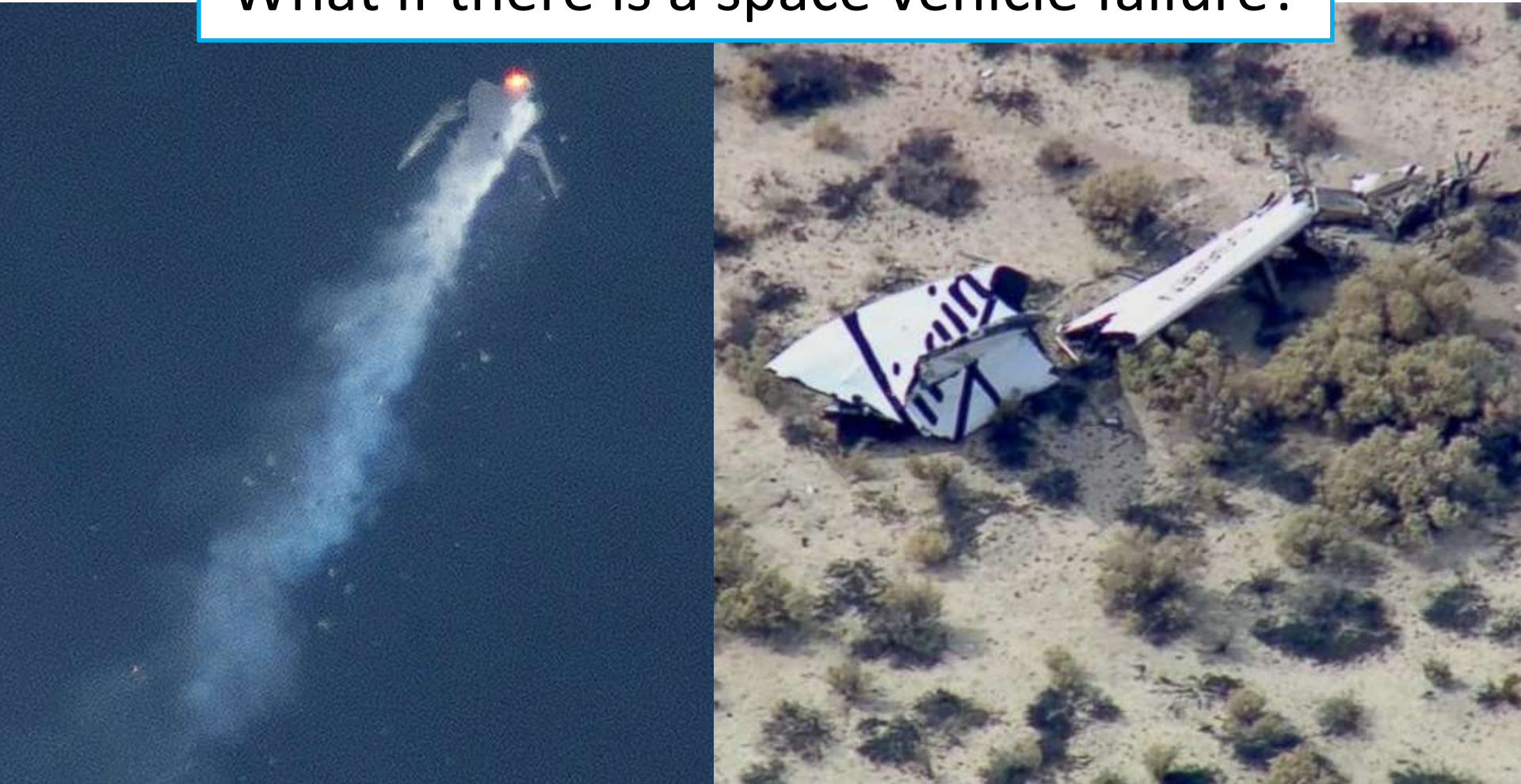
Space Transition Corridor

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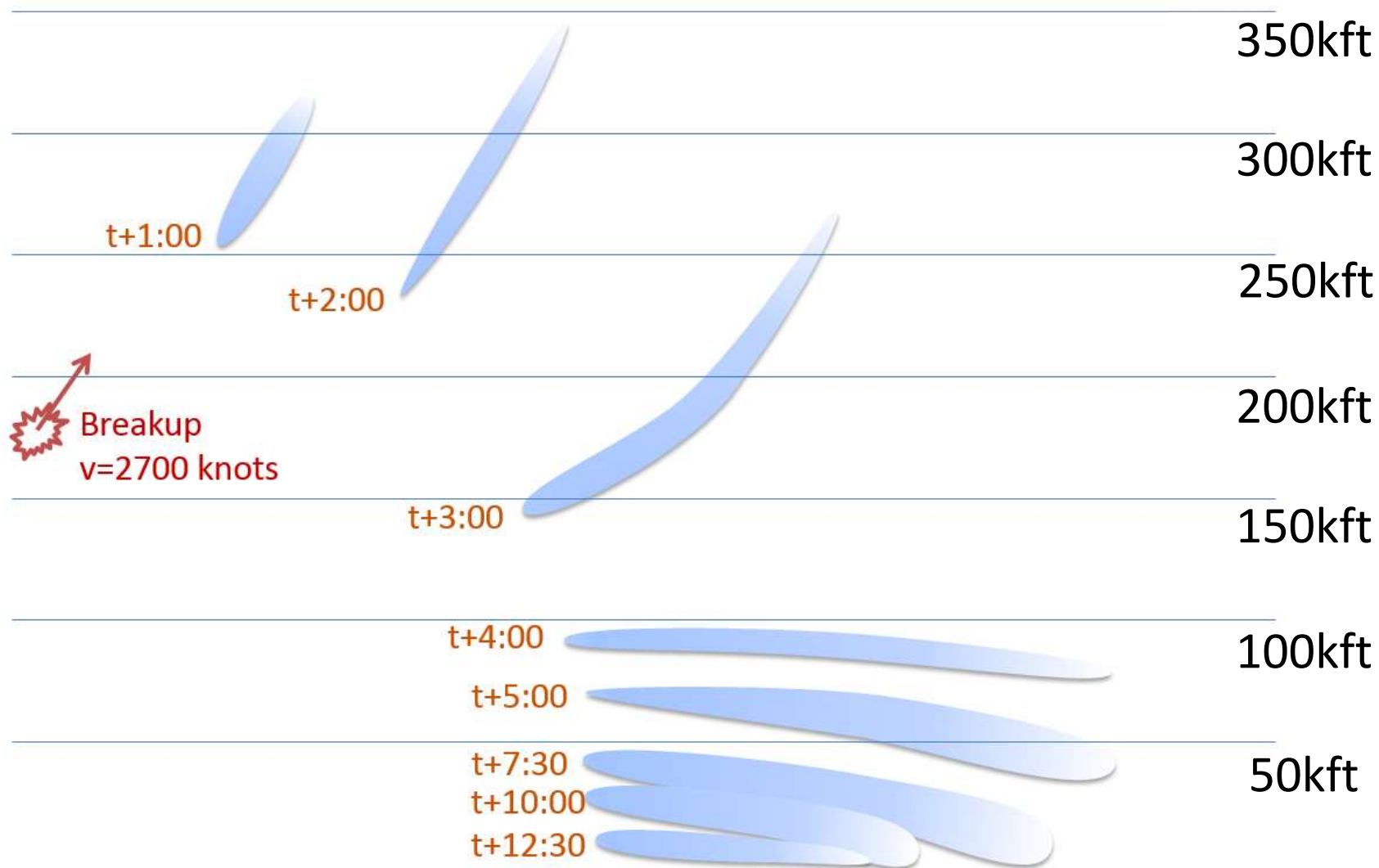
What if there is a space vehicle failure?

Spaceship 2 Structural Failure, October 31, 2014

Debris Fall from HITL Launch Failure

350kft

300kft

t+1:00

250kft

t+2:00

Breakup
v=2700 knots

200kft

t+3:00

150kft

t+4:00

100kft

t+5:00

50kft

t+7:30
t+10:00
t+12:30

SVO Human-in-the-Loop

Federal Aviation Administration
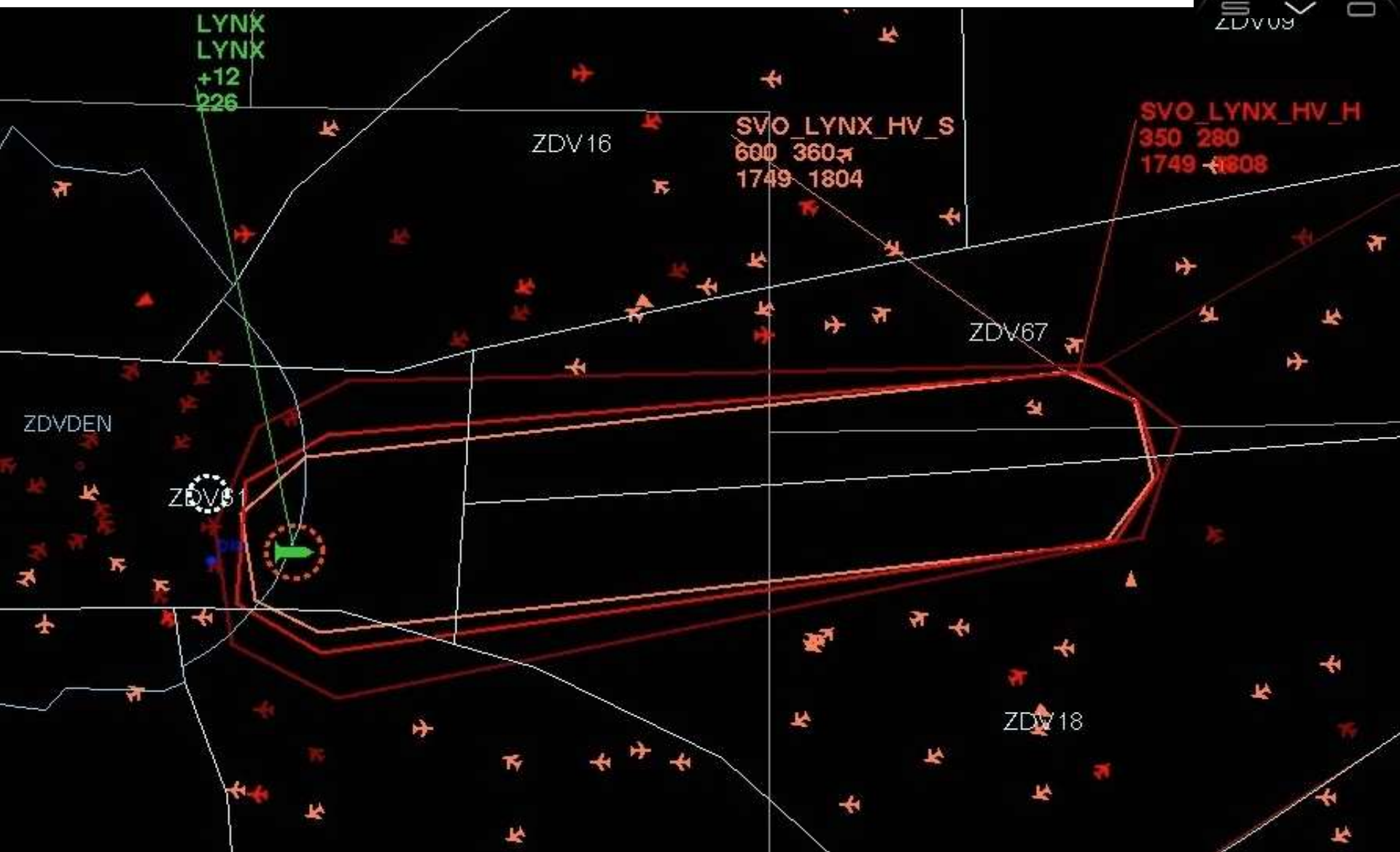
SWIM Services

- Dynamic SAA – Input from operators in real time allows improved communication and data sharing

- Space Transition Corridor (STC) & Debris Hazard Volume (DHV) available to subscribers
  - FAA
  - AOC
  - Flight Deck
  - Spaceport
  - Space Vehicle Operator

Federal Aviation Administration

Potential Operator-Provided Information

- Estimated ANSP entry time (landing)
- Estimated ANSP exit time (launch)
- Fuel type (solid, liquid, etc)
- Number of stages (or jettisons)
- Number and Types of engines
- Payload details
- Vehicle type (e.g., expendable or reusable)
- Mission type (e.g., orbital or suborbital)
- Space Vehicle Operator
- Nominal and Off-Nominal Hazard area
- Debris catalog

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Information Sharing in Commercial Space:

Space Data Integrator

Federal Aviation
Administration

By: Dan Murray
Office of Commercial Space Transportation,
FAA

Date: November 4, 2015

- FAA directly supported NASA on all 22 Shuttle missions since STS-114 in August of 2004
- Lessons learned pointed to the need for an FAA capability to increase its situational awareness during launch and reentry, and:
  - Accurately model a launch/reentry vehicle failure
  - Identify potentially affected airspace
  - Assess impacts on air traffic
 - <u>Quickly distribute information</u> to affected parties
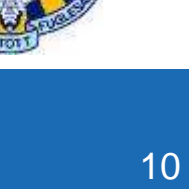
Current Capabilities: Reentry from Orbit

Planning → **Realtime** → **Post-mission**

Operator Display

Monitoring

Traffic Situational Display (TFMS)

Response

Safety Tool (laptop)

Hotline
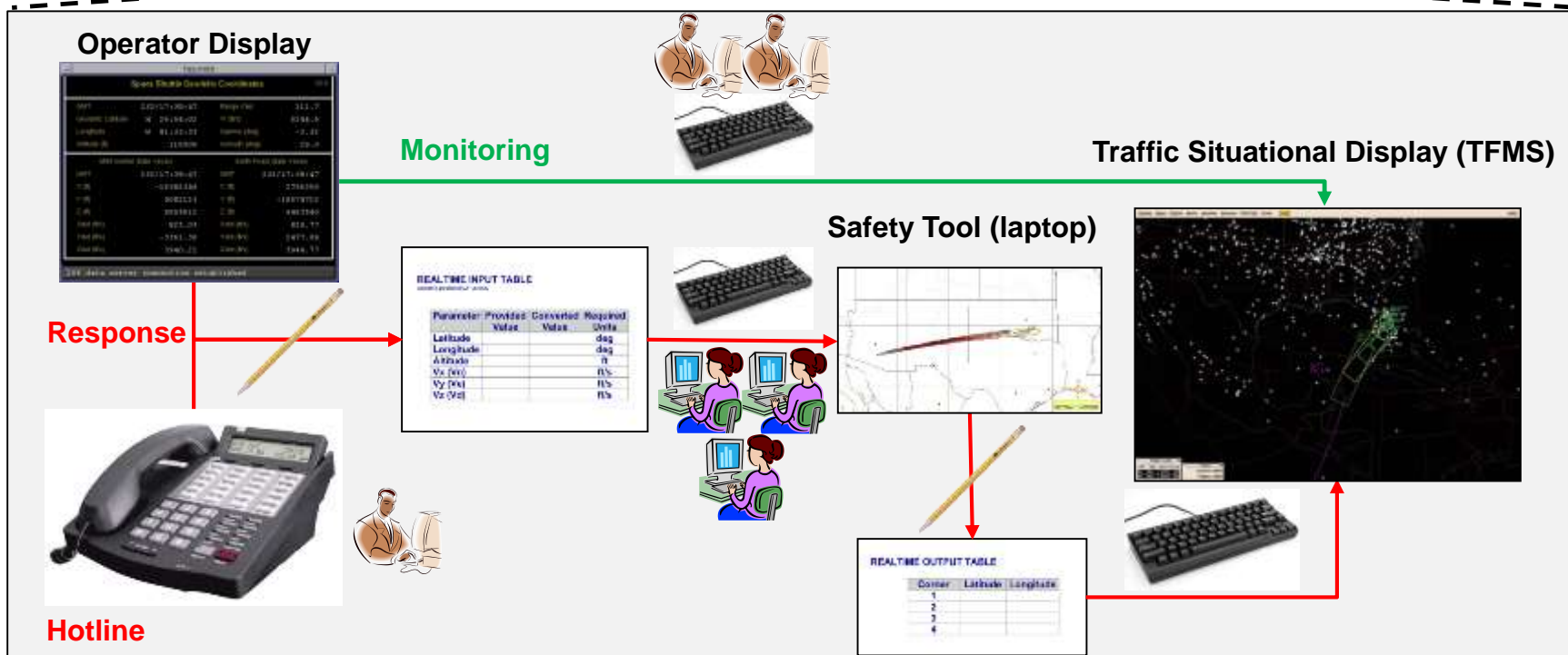
FAA Administrator's Strategic Initiatives

- http://www.faa.gov/about/plans_reports/media/aa_strategic_initiatives_summary.pdf

- Over the next several years, the FAA is committed to making measureable and steadfast progress toward a vision for transforming the aviation system to reflect the highest standards of safety and efficiency, and to be a model for the world.

- Initiatives lay the foundation for the aerospace system of the future

- Commitment to delivering benefits through technology and infrastructure, including "New Entrants - Commercial Space"

Federal Aviation Administration
Strategic Initiatives
2014-2018

February 19, 2014
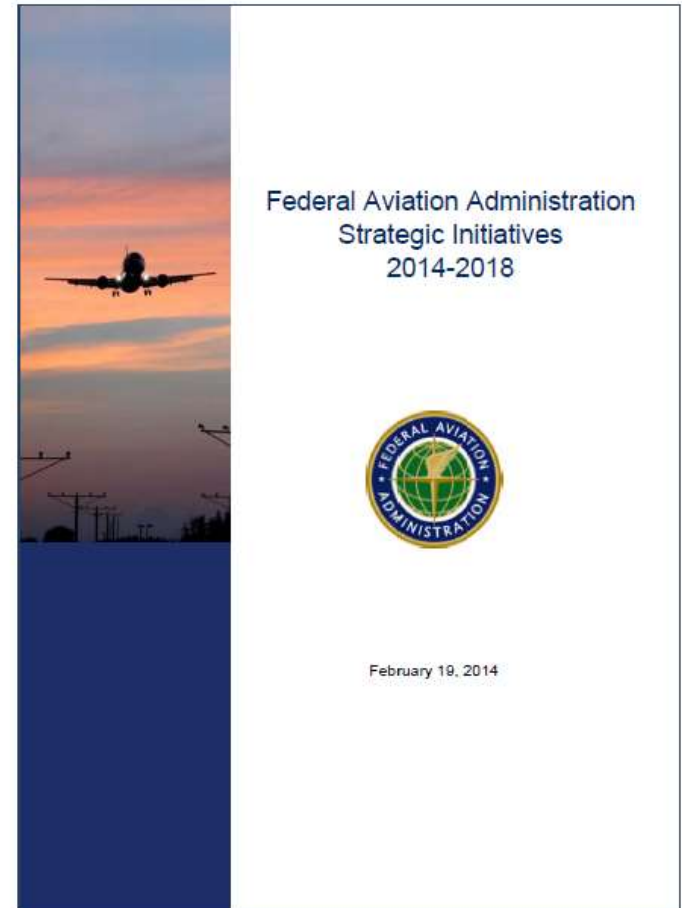
Space Data Integrator (SDI) Project

- <u>Purpose:</u> Demonstrate the benefits of automating the manual processes currently used by the FAA Joint Space Operations Group during commercial launch and reentry operations to distribute mission related information

- <u>Approach:</u> Develop a prototype launch and reentry space vehicle data integrator capability that provides time accurate data for:
  - Automated situational awareness
  - Monitoring of space launch/reentry vehicle transitions through the NAS
  - Notice and response to off-nominal scenarios

- <u>Goal:</u> Define requirements for near term operational capabilities that will integrate commercial launch and reentry vehicle data into current FAA systems

SDI Elements

- **Space Data Integrator (SDI) Server**
  - Build a valid flight plan using trajectory info provided by launch/reentry vehicle operator
  - Convert incoming, time-accurate launch/reentry vehicle operator telemetry state vector data into:
    - Position messages for input to Traffic Flow Management System
    - State vectors for input to aircraft hazard area computation tool
    - Vector and mission event data for display
- **Enhanced Space Data Display (ESDD)**
  - Display data from launch/reentry operator that cannot be displayed in current FAA systems:
    - Predicted/actual position, impact points, and traces
    - Countdown timers for key mission events
    - Indicators of data connectivity and quality
  - Monitoring these parameters provides FAA with early indication of off-nominal conditions

Enhanced Space Data Display

SDI Elements

- TFMS Traffic Situation Display (TSD)
  - Display predicted route of flight based on flight plans submitted via SDI
  - Display launch/reentry vehicle current position based on messages submitted via SDI
  - Move Range Risk Analysis Tool (RRAT) output Aircraft Hazard Areas (AHAs) to TFMS and convert to Flow Evaluation Area (FEA) format for recall on TSD
  - Display AHAs as FEAs

Remaining Schedule for Demonstration

1/23/15: Complete System Engineering and Trade Study Document

1/28/15: Purchase SDI Demonstration Hardware

Feb-Mar: Software Development and Test

5/29/15: Complete Integration Testing

7/3/15: Complete On-site Testing (FAA Command Center)

7/28/15: Ready for Operational Demonstration

TBD: Operational Demonstration during upcoming Dragon reentry

Partners

- Office of Commercial Space Transportation (AST)

- Air Traffic Organization (ATO)
  - System Operations
  - Mission Support
  - Technical Operations

- NextGen (ANG)

SPACEX

Millennium Engineering and Integration Company

CGH Technologies

Advanced Sciences & Technologies

Questions?

Questions / Discussion

Federal Aviation Administration

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